

CLAIMS

What is claimed is:

1. A surface-mountable
electrical circuit protection device
5 comprising:
a first PTC element having first
and second surfaces, a first electrode
attached to the first surface;
a second PTC element having first
10 and second surfaces, a second electrode
attached to the second surface;
a third electrode positioned
between the first and second laminar PTC
elements and having an electrical
15 resistance, the third electrode connected
to the second surface of the first PTC
element and the first surface of the second
PTC element and having a main portion and a
sub-portion, the main portion being
20 separated from the sub-portion by an
element having a higher electrical
resistance than the electrical resistance
of the third electrode;
a first electrically conductive
25 end termination wrapping around a first end
of the device and electrically contacting
the first and second electrodes; and
a second electrically conductive
end termination wrapping around a second
30 end of the device and electrically
contacting the third electrode.

2. The device of Claim 1,
wherein the first and second electrodes
comprise a main portion and a sub-portion.

5 3. The device of Claim 2,
wherein the main portions of the first and
second electrodes are physically and
electrically separated from the sub-
portions, respectively.

10 4. The device of Claim 1,
wherein the first and second PTC elements
are physically joined between the sub-
portion and the main portion of the third
15 electrode.

20 5. The device of Claim 1,
wherein the electrodes are comprised of a
metal foil.

25 6. The device of Claim 1,
wherein the first and second PTC elements
are comprised of a conductive polymer.

30 7. The device of Claim 1,
wherein the first end termination is in
direct contact with the sub-portions of the
first and second electrodes and the main
portion of the third electrode.

8. The device of Claim 1,
wherein second end termination is in direct
contact with the sub-portion of the third
electrode and the main portions of the
5 first and second electrodes.

9. The device of Claim 1,
wherein the first and second end
terminations are comprised of first and
10 second conductive layers.

10. The device of Claim 1
further comprising an electrically
insulating layer deposited on the first and
15 second electrodes between the first and
second end terminations.

11. The device of Claim 10,
wherein the electrically insulating layer
20 is in direct contact with the first PTC
element between the main portion and the
sub-portion of the first electrode and is
in direct contact with the second PTC
element between the main portion and the
25 sub-portion of the second electrode.

12. A surface-mountable electrical device having a first PTC element electrically connected in parallel to a second PTC element, said device
5 comprising:

a first PTC element having first and second electrodes attached to opposite faces thereof, the first and second electrodes having a main portion and a sub-
10 portion, respectively;

a first end termination wrapping around a first end of the first PTC element and making electrical contact with the sub-portion of the first electrode and the main
15 portion of the second electrode;

a second end termination wrapping around a second end of the first PTC element and making electrical contact with main portion of the first electrode and the
20 sub-portion of the second electrode;

a second PTC element having third and fourth electrodes attached to opposite faces thereof, the third and fourth electrodes having a main portion and a sub-
25 portion, respectively;

a third end termination wrapping around a first end of the second PTC element and making electrical contact with the sub-portion of the third electrode and
30 the main portion of the fourth electrode;

a fourth end termination wrapping around a second end of the second PTC element and making electrical contact with

the main portion of the third electrode and
the sub-portion of the fourth electrode;
and

an electrically conductive member
5 connecting the first and third end
terminations and the second and fourth end
terminations, respectively.

13. A surface-mountable
10 electrical device having a first PTC
element electrically connected in parallel
to a second PTC element, said device
comprising:

the first PTC element having
15 first and second electrodes attached to
opposed surfaces thereof, the first and
second electrodes having a main portion and
a sub-portion separated by an insulating
member, first and second end terminations
20 wrapping around opposite ends of the PTC
element, respectively, the first end
termination contacting the main portion of
the first electrode and the sub-portion of
the second electrode, the second end
25 termination contacting the sub-portion of
the first electrode and the main portion of
the second electrode;

the second PTC element having
third and fourth electrodes attached to
30 opposed surfaces thereof, the third and
fourth electrodes having a main portion and
a sub-portion separated by an insulating
member, third and fourth end terminations

wrapping around opposite ends of the second PTC element, respectively, the third end termination contacting the main portion of the third electrode and the sub-portion of the fourth electrode, the fourth end termination contacting the sub-portion of the third electrode and the main portion of the fourth electrode; and

the first and second end terminations being electrically and physically connected to the third and fourth end terminations, respectively, such that the first and second PTC elements are electrically connected in parallel.

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14. A surface-mountable electrical circuit protection device comprising:

a first PTC element having first and second electrodes attached to opposite surfaces thereof;

a second PTC element having first and second electrodes attached to opposite surfaces thereof;

a conductive member physically connecting the first and second PTC elements to form a laminate, the laminate having first and second ends;

a first insulator deposited on the first end of the laminate,

a second insulator deposited on the second end of the laminate;

a first conductive end termination deposited on the first insulator and making electrical contact with one of the following:

- 5 (i) the first electrode of the first PTC element and the second electrode of the second PTC element;
- (ii) the second electrode of the first PTC element and the first
- 10 electrode of the second PTC element; or
- (iii) the conductive member;
- and

a second conductive end termination deposited on the second

15 insulator and making electrical contact with one of the following which is not in electrical contact with the first conductive end termination:

- (i) the first electrode of
- 20 the first PTC element and the second electrode of the second PTC element;
- (ii) the second electrode of the first PTC element and the first
- electrode of the second PTC element; or
- 25 (iii) the conductive member.

15. The device of Claim 14, wherein the first and second PTC elements are comprised of a polymer having

30 conductive particles dispersed therein.

16. The device of Claim 15, wherein the conductive member is comprised

of a material selected from the group including a conductive polymer, a conductive thick film ink, solder, and a conductive adhesive.

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17. The device of Claim 15, wherein the first end termination is in direct contact with one of the first and second electrodes of the first PTC element and one of the first and second electrodes of the second PTC element.

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18. The device of Claim 17, wherein the first insulator electrically separates the first end termination from the other of the first and second electrodes of the first PTC element, the conductive member, and the other of the first and second electrodes of the second PTC element.

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19. The device of Claim 17, wherein the second insulator electrically separates the second end termination from the electrodes which are in direct contact with the first end termination.

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20. The device of Claim 15, wherein the first end termination is in direct contact with the conductive member.

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